

the pulmonary capillary, and of the blood-disk, all of which exert a condensing action, of the result of which it is impossible to furnish any numerical estimate.

Brought into presence of the hæmatin, the oxygen may possibly associate itself therewith, in a manner analogous to that which we witness, under similar circumstances, with deoxidized indigo.

In thus attempting to correct the account ordinarily given of the function of respiration, the only original points I present are, 1st, the necessity of admitting the *constant action* of the circular organic museles; 2d, the *condensing action* of the three tissues, the wall of the pulmonary vesicle, of the pulmonary capillary, and of the blood-disk; 3d, the probable analogy between the relation of hæmatine, and another nitrogenized colouring principle, indigo.

ART. III.—*On Pleuritic Effusions, and the Necessity of Paracentesis for their Removal.* By HENRY I. BOWDITCH, M. D., one of the Physicians of the Massachusetts General Hospital. (Read before the Boston Society for Medical Observation, Oct. 20, 1851.) [With five wood-cuts.]

I HAVE chosen the above title to this memoir, in order that two distinct ideas may be brought before the mind, viz.: 1st, the simple idea of effusion of a fluid into the cavity of the pleura without reference to the character of the liquid, the cause of the effusion, or the length of time it has existed; and 2d, that paracentesis can be performed with safety, and should be done much more frequently than it is at present. I think that, in the course of this communication, I shall be able to convince the reader that individuals have died who might have been relieved by an operation; that paracentesis, as performed now by some Europeans, and in some parts of America, may be done with, at least, partial success in most cases, and with complete success and cure of the patient in others. Finally, I shall bring forward a method which, though originally suggested in Europe, was improved, and, so far as I know, first used in this country by Dr. Morrill Wyman, of Cambridge, Mass., a method more simple, less dangerous, and, in most cases, quite as effectual as the method pursued elsewhere.

From the times of Hippocrates, paracentesis thoracis has been at times performed, but generally as a last resource, and with a belief in the great danger attendant thereupon. Before Laennec's discovery of auscultation, it was impossible to arrive at a sufficiently accurate diagnosis at an early period of the disease; and, when some diagnosis had been made, the operation, as then performed, was much more dangerous than that which will be advocated in this paper. Laennec advises that the operation should be performed where dyspnoea, threatening life, supervenes in an acute pleuritic attack, and also in

chronic cases where other remedies fail. Neither this great author, nor Récamier, seems very hopeful of success. Since 1843, Messieurs Troussseau and Barby have repeatedly brought forward the necessity of the operation in acute pleurisy.* Mons. Valleix evidently disapproves of it, and would advise waiting, in acute cases, even where there is much dyspnoea; a course of proceeding I cannot too much deprecate whenever the physician can make use of the simple method already alluded to. Mons Valleix allows that paracentesis may be performed with more propriety, and with a doubtful hope of success in chronic cases. He is, however, by no means prepared to recommend it.†

Various modifications of the trocar and canula have been proposed by Messrs. Reybard, Sedillot Schuh, of Vienna, and Raciborski.‡ By most, if not by all of them, a larger trocar is employed than that used in the cases to be recorded in this paper.

Contemporary with Troussseau, Messrs. Hughes and Cock used the trocar in London with much success. In 1840, they began to operate. Their papers on the subject§ are very important, and it seems singular that they have not sooner affected medical practice on this side of the Atlantic.

Since their publications, several cases have been read, and discussions held thereupon, in London, and on the Continent. Among these, I may allude to articles published by Dr. Hughes, in 1847;|| one read by Hamilton Roe, M. D., in April, 1844, on which a long discussion took place;¶ also one by Dr. Theophilus Thompson.**

A very interesting case is likewise given in the *London Medical Gazette*, April, 1850.

From these various papers I infer that the operation, simplified as it is in modern times, is strongly advocated by a few, and as strongly opposed by others, and looked upon with indifference by the mass of European physicians.

I pass now to the state of opinion in America. I think it may be safely asserted that the general voice of medical and surgical practitioners is, 1st, against the operation, even in chronic cases; 2d, that the operation, used and generally recommended, is the old plan of dissecting down and making a permanent opening between the ribs—an operation which well deserves the stigma cast upon it by a distinguished auscultator, who, in conversation with me, said he should be as willing to have a bullet shot through the chest as to have it performed on one of his patients.

My own experience in the matter of pleuritic effusions and of paracentesis thoracis, in connection with them, is as follows:—

Twelve or fifteen years since I saw, in consultation with another physician, a sailor, who had been for many months subject to dyspnoea and general de-

* Guide du Médecin Praticien, &c., par F. L. I. Valleix, vol. i. p. 564; Paris, 1850.

† Ibid., p. 575.

‡ Ibid.

§ Guy's Hospital Reports, April and Oct., 1844.

|| London Medical Gazette.

¶ London Lancet, vol. ii. 1844, p. 190.

** Ibid., p. 191.

bility, slight cough, and no hectic paroxysms. One side of the chest was much more distended than the other. In one part of the breast it was particularly prominent, though there was nothing indicating a disposition to point. The side was perfectly flat on percussion, and the respiratory murmur could scarcely be heard. When I saw him, he was able to walk about. I suggested to the attending physician the propriety of puncturing with an explorer, and if a fluid was found, I advised an operation with the bistoury.

This was objected to, and in about two months the patient died. The pleural cavity was found *distended* to its utmost, by an immense quantity of a nearly transparent serum. This was the sole disease. Not a trace of tubercle, in either of the great cavities, could be found after a thorough examination. I felt convinced, at that time, that a trocar might have saved the man's life.

The second case, which I saw soon after, was as follows:—

A young woman, who, so far as I could learn after a minute inquiry into all her symptoms, had been perfectly well until taken with the signs of acute pleurisy, entered the Massachusetts General Hospital under the care of Dr. J. Ware. The usual remedies were applied; but the chest became fully distended, and after some months of residence she began to have rales at the top of the chest, and she eventually died of phthisis.

The question arose in my mind, if, after ineffectually using remedies, a puncture had been made, and the system relieved of the distress caused by so large an effusion, might not our patient have recovered? This question arose after phthisis had developed itself; but as I had, at the time of first seeing her, no idea that pleurisy could be the cause of phthisis, I did not feel the importance of paracentesis.* I certainly should be unwilling to allow any case under my charge to proceed, at the present time, as in the case just related.

In 1848, I had under my charge, at the hospital, a young girl. The right pleura was evidently distended with fluid, the result of acute pleurisy. I called a consultation of the physicians and surgeons, and, contrary to my opinion, it was decided not to operate according to the old method. The girl died of phthisis, months afterwards; no external or internal remedies having had the least influence on the amount of the effusion.

Soon after this, another case occurred in the hospital under my charge; and, at my request, Dr. J. M. Warren operated in the usual method recommended in all books of surgery. Partial relief was obtained, but the amount of suffering undergone by the patient during the operation, and the fact that an aperture is usually left open by this method, decided my views upon that operation, and that I would never recommend it unless under very urgent circumstances.

Soon afterwards I advised, in consultation with Dr. Stone, of this city, the

* I am well aware that some, who do not believe that pleurisy ever excites tubercular action, will say that I have no proof that some tubercles had not been existing previously to the commencement of the acute pleuritic attack. This criticism may be justly made, although I have no doubt in the premises, because my mind was fully convinced of the importance of a thorough investigation of the previous condition of a patient when attacked with pleurisy. In the instance related in the text, the person had all her functions in a perfect state, so far as I could learn, up to the hour of the acute attack.

puncture of the chest of a man who, though evidently suffering from organic disease of the heart, was likewise much oppressed by a recent effusion into one pleural cavity. A quantity of fluid was removed by the common trocar and canula, with some temporary relief.

In 1849 or '50, I saw the paper, already spoken of, by Messrs. Hughes and Cock, in *Guy's Hospital Reports*, and by it my views were confirmed as to the safety and propriety of paracentesis by the trocar and canula.

This paper afforded ample proof of the safety of the operation, as performed by these gentlemen, and I determined strongly to advise it in any case I might meet.

In the autumn of 1849, I was consulted in the case of a little girl, aged four years, who had been ill chiefly with attacks of dyspnoea for several weeks. I found her sitting on her mother's knee, apparently quite comfortable, but the physical signs of extensive pleuritic effusion were manifest. I advised the puncture; but a surgeon having been summoned, the little patient appeared so well that it was decided to *delay the operation until more urgent symptoms should occur*. Within forty-eight hours she died, on the supervention of a sudden fit of dyspnoea. I was allowed to use the trocar after death, in order to verify the diagnosis, and pure pus gushed out. I believed that death might have been prevented had the operation been done.

Finally, the following came under my charge, and, as it was the first case which I had control of in which Dr. Wyman's method was used, I shall enter into some detail:—

CASE I.—B——, æt. 28, house-painter, I saw, April 17, 1850, at Woburn, his place of residence. His history was as follows: Five weeks before, having been previously quite well, he was attempting to raise a ladder to the side of a house upon which he was working. By accident, the whole weight of the ladder rested on him, and, directly after a great effort to sustain it, he was seized with a violent pain in the left side of the thorax. Some cough and hæmoptysis supervened, and he was confined to his room for nearly a fortnight, under the care of a homœopathic practitioner. At the end of that time, feeling better, and all his violent symptoms having subsided, he was allowed to go about and to transact business in Boston. In a few days, he became more ill than ever, and was considered by his friends and physician to be dying of a "rapid consumption." At the end of five weeks from the first attack, I was called. The patient was in bed in a semi-recumbent posture, suffering so much from dyspnoea as to be unable to easily converse with me. His pulse was 120, quite small. He was extremely emaciated. His voice was clear, and his countenance, though thin and expressive of suffering, had not exactly a phthisical aspect. It appeared that he had been unable to lie on his right side since his first attack, and not on his back until a week previous to my visit. Owing to the dyspnoea, I did not ask many questions, but, on examination of the physical signs, discovered as follows:—

Intercostal spaces of the left side enlarged. Total flatness, front and back, even to the apex of the same side.

Absence of respiratory murmur in the same parts, save at the very apex. Distant ægophony at the middle of the back. The heart was beating to the right of the sternum.

My diagnosis was effusion of fluid. No *positive proof* of pulmonary disease.

My proposed treatment, as the only means of saving his life, was the puncture of the thorax.

The friends objected, but the patient consented, and allowed himself to be removed to another boarding-house. Dr. Morrill Wyman, of Cambridge, I had previously summoned in consultation, as I knew that he had operated, a short time previously, with success upon a case of acute pleurisy threatening suffocation.

Dr. Wyman agreed with me as to the nature of the case, and the necessity of drawing off the fluid. Accordingly, on the second day after our first examination, Dr. Wyman used an *exploring* trocar, with a strong suction-pump attached thereto. The patient was placed in a chair, and a puncture was made* about four inches from the vertebra, and just below the angle of the scapula. Only a small quantity of bloody fluid exuded, although the trocar seemed to be introduced as far as prudence dictated. In another part of the paper I shall allude to this failure. I will now simply state that we decided that it would be well to desist. The next day, however, having again thoroughly examined the case, I summoned Dr. Wyman, and told him another puncture was, in my opinion, necessary, and that I believed the instrument could be introduced, *capulo tenuis*, without danger. No severe symptom, and only slight fatigue, had followed the first effort. Two days subsequently (April 23) we found more fulness and great tenderness of the left breast and side. The patient had perspired freely at night. His tongue appeared healthy; his appetite was good; he was somewhat costive. His cough had been less, and the expectoration had been about $\frac{3}{4}$ ii of opaque mucus daily. Dr. Wyman operated a little back of the previous puncture, which was scarcely perceptible. Just before the operation was done, a violent fit of coughing occurred in consequence of the effort needed to place him in a chair. The patient was completely exhausted and bathed in sweat. His pulse rose to 138, and he felt quite faint. We were obliged to allow him to lie down. After resting some minutes, he was raised again, and $\frac{5}{16}$ x of pure pus drawn out through the trocar. The patient bore the operation very well, was less fatigued than by his access of cough, and felt relieved, in some degree, of the oppression about the chest.

He was ordered: Morph. acet. gr. $\frac{1}{4}$; pulv. ipecac. gr. $\frac{1}{4}$; in pill at night. R. Potass. iodid. gr. ii; syrup symp. q. s. A. M. and P. M. Wine (unless heated by it) in small quantities.

From the time of the operation, April 23d, I date the commencement of his recovery, although there was no very sudden and decided improvement in any one of the rational or physical signs.

April 25th.—He complained much of tenderness of abdomen, and the bowels were costive. The pulse was 120, and he was bathed in sweat. On percussion, a little clearer sound was heard about the clavicle, but the respiration was decidedly bronchial there, and very obscure below. The heart was still beating most strongly to the right of the sternum, but was less so than before. Occasional attacks of dyspnoea.

He was ordered ol. ricini and a cathartic enema.

During the following night he had a sense of great distension of the chest, and thought that another puncture would be needed—but during a violent

* A description of the method of performing this operation will be given in another part of this paper.

cough he raised a large quantity of "matter" which gagged him, and afterwards some relief was obtained.

26th. All symptoms improving.

27th. Night "delightful;" cough much less. Between second and third ribs on left breast, one inch from the sternum, was a small crepitating tumour, evidently from air in the cellular membrane. Also a small tumour in the back of chest, apparently containing fluid, and seemingly about to open. I ordered a little beefsteak at dinner if he desired it, and had no abdominal pain. Half of the opiate pill at any time when the cough was severe.

Soon after this I was obliged to leave Boston for several weeks, and our patient was put under the care of Dr. William H. Thayer of this city.

On 28th, the *Mistur. Ferri Comp.* was ordered instead of wine, as that seemed to "*brace*" him too much. This medicine was continued and the iodic potass. omitted. He gave up opiates on 8th of May (15th day from operation). His pulse varied from 120 to 113, to May 7th, with the exception that on May 10th and 13th, when sitting up, it rose to 132-4. The cough gradually subsided, as likewise did the expectoration, which on 17th was scarcely any. His respiration continued somewhat laboured. The digestive function was well, except that there was constipation. On the 1st of May (seven days after the operation) he sat up an hour. On 8th walked the room without fatigue, and 17th (24th day from operation) rode easily half a mile.

Of the physical signs, it was recorded that the emphysematous tumour in front had nearly gone on May 1st, and that no discharge ever took place from the fluctuating swelling in the back.

On May 28th (35th day from operation), I again took charge of him, and my report was as follows. Sits up much of the day; digestive functions perfect; has gained flesh; can walk half an hour without fatigue. No severe pain, but a soreness on coughing in the left chest; coughs most at night; expectorates about $\frac{3}{4}$ ii daily. No hectic, but occasionally sweats. P. 124, sitting up; lies on either side.

Percussion front and back, nowhere completely dull. To third ribs scarcely any difference between the two breasts; below, less at left. The prominence of the left breast and the emphysema were gone; respiratory sound rude, almost bronchial; throughout the whole of the left breast a rubbing sound; no resonance of voice or crackling. Behind, obscure at apex; slight rale at the base; no regophony. Learning that he had partaken rarely of meat, I ordered steak daily with wine, if it could be borne.

June 24th (62 days from operation). Steady improvement; had gained five pounds of flesh in two previous weeks, and had worked for two hours upon his farm. No cough for two weeks; no pain or dyspnoea except a little on walking. He was, in fact, so altered in aspect that I did not recognize him on his entrance to my office in Boston. P. 92, after rapid walking.

On inspection, chest slightly contracted, and left shoulder fallen. Percussion gives less sound throughout the whole of the left than the right side, but no flatness except at the very base. Murmur everywhere obscure at the left, hardly heard in the lower third of back. Where heard it is more healthy than formerly. Voice rather resonant under the left clavicle. Heart in its normal situation. He was directed to be cautious, and to engage in some business which would give sufficient out-of-door exercise without too much labour.

From this period he gradually resumed work, and I did not see him again

until Dec. 18th, *i. e.* just eight months from the time of my being called to him, and nine months and a half from the first hours of his illness. I found he had worked at his trade for three months. Till within a month, he had had some soreness about the chest, and when I saw him he had it occasionally after "taking cold." He had steadily improved, weighed five or ten pounds more than ever before; looked in perfect health, and was of a ruddy complexion.

But the most unlooked-for change had taken place in the physical signs. Inspection showed no difference between the sides! Mensuration proved the left to be half an inch only smaller than the right.

Percussion gave nowhere any difference between the two sides, save a little difference of note in favour of the right, under the axilla. Respiratory murmur equally pure and soft throughout both lungs.

There are many points of interest in this case, among which I would name the following. *First.* Neither of the punctures of the chest caused any marked, immediate, or subsequent evil results. No dressing was needed on either occasion over the slight mark left by the trocar; aperture there was none, as the parts adjacent contracted strongly and closed it. *Second.* I would note the immediate relief to the patient, which, though not very marked in any one symptom, was nevertheless manifest to himself and to us. He appeared stronger, and better able to help himself after the operation than before. *Third.* The return of the oppression about forty-eight hours after the last puncture, and the relief obtained from the copious expectoration of "matter," and the subsequent emphysema on the left breast, are points of deep interest. *Fourth.* The gradual, but entire, restoration of the functions of the lung, so that nothing but a very minute examination could discover any difference between the two sides of the thorax, is worthy of notice. This result has been, in my practice, unusual—and the question arises whether the early removal of a large part of the effused fluid may not be the cause of the non-contraction of the chest, such as usually occurs in severe chronic pleurisy, which this case would probably have terminated in, if the operation had not been performed. *Fifth.* The quantity of pus extracted, though small compared with what we hoped to get, was, nevertheless, sufficient to give relief, and nature seemed able to take care of the remainder. This fact seemed singular at first, but having noticed the same effect in other cases, I am led to believe that frequently the absorbents are unable to act in consequence of the *over-distension* of the adjacent parts, and, if that be relieved, they become immediately able to resume their functions. Dr. Hamilton Roe sustains the same view.*

The results of this case were so satisfactory, that I decided to make use of the operation of paracentesis in any case where there was an effusion, causing great dyspnoea, even if organic disease should be found to exist in the lungs or heart. I will now lay more briefly before the reader more facts bearing upon this subject.

* London Lancet, vol. ii. 1844, p. 190.

CASE II.—W. D. F., a seaman, aged 56, came from Wellfleet to consult me, Oct. 1, 1850. I learned that he had been usually at sea, and had never been liable to illness of any kind, until dyspnœa began, about seven or eight years ago. It was slight at first, with some pain at the epigastrium. He had been worse in winter than summer; but from the commencement he had found he could not do anything rapidly without suffering from dyspnœa. His other functions generally were well performed.

From March he had been growing worse. He was then at sea, very much exposed, and a cough had commenced. He had arrived home five weeks previous to consulting me, and felt obliged to give up all work, owing to the aggravation of all his symptoms. Two weeks before his arrival, orthopnœa began, and he had been unable to lie down more than half the night for seven weeks. Of late, there had been pain and swelling of the abdomen, and œdema of the legs, and even slightly of face. After the commencement of remedies his appetite had failed him, he had had a bad taste; the urine was dark and small in quantity. His aspect when he entered my room was that of a man suffering from the greatest oppression in breathing; his lips were livid, he spoke with great difficulty and with a constant panting. He walked very feebly. His pulse was 116, small and irregular.

On percussion, he was flat from below the second rib of the left side, front and back. Change of position changed the result, the most depending parts being always flat. The respiratory murmur was puerile in the right lung; obscure throughout left apex, and wanting below the third rib, front and back. Some mucous rûle at the base of the right lung.

Ægophony near the lower third of the left breast and corresponding part of the back. Impulse of heart felt more under the sternum than usual, and over a rather large space. No bellows murmur. Sounds of the heart loud.

The diagnosis was probably disease of the heart, and great effusion into the cavity of the left chest. The question arose, whether any good would result from puncturing the pleura.

This question was decided by the increased dyspnœa that ensued the next day. The patient on that day was able to be up and dressed, and with great difficulty could get down stairs, but going up stairs seemed almost to take away all power of breathing. In the evening, I punctured below the lower angle of the scapula, between the ninth and tenth ribs, and drew off, with little difficulty, and great relief, 5xxxvi of a clear, yellowish, serous-like fluid, which, however, soon coagulated into a thin, jelly-like mass, floating in a liquid. No faintness, no bleeding, followed the puncture. Patient felt stronger, and arose and put on his coat with much more ease than he had done for weeks previously. As he had had but little sleep for several nights, I ordered Dover's powder five grains at bedtime, and to be repeated if needed.

The next morning (Oct. 3), I found that he had had a better night than for six weeks; had lain down all the time; no "choking spells" since the operation, but some tickling in the throat; œdema of legs and swelling of abdomen less. Occasional slight pricking pain in the side, near the point of puncture. Pulse 108; lips less livid; whole countenance improved, less anxious. He was ordered a cathartic of jalap grs. x, and potass. sup. tart. 5ss.

After the operation, he was directed to commence with the following, three times daily: potass. iodid. gr. ii, sarsaparil. syrup ʒi.

Diet, bread and weak tea night and morning. Small piece of fresh meat and vegetables, noon.

From this time until Oct. 12, *i. e.* for ten days, he had no attack of severe

dyspnoea; but for two or three days previous to the 12th he found that he was gradually becoming more oppressed. At times, he was obliged to sit up in bed at night. The symptoms previous to 12th were as follows: His cough was but slight, with very little expectoration. I kept the bowels freely opened with medicine, and continued the potass. iodid. The pulse on 6th was 96. The pain in the chest near the puncture was very soon relieved by applications of flannel wet in hop tea.

On the 5th, percussion gave a clearer sound; some resonance even three inches below the lower angle of the scapula. Rubbing sound over the whole breast, except over the cardiac space, and the respiratory murmur was heard, though much less distinctly than in the other lung, even to the base of the chest. Egophony gone. Voice only slightly modified.

On 10th, he felt that the obstruction of his breath was returning; and percussion, with change of posture, showed an increase of fluid in the pleura. The heart, however, was more nearly in its right position. Its sounds and impulse were very obscure. No distinct bellows murmur.

On 12th, he reported orthopnoea again during the whole night, though no severe accesses such as he had previous to the operation. I proposed a second puncture as a source of temporary relief. It was consented to. I introduced the instrument two inches back of the first puncture, which was scarcely perceptible.

Thirty-two ounces of a fluid, similar to that first extracted, were drawn out. The same relief was obtained. Scarcely any pain was experienced until the very last part of the operation, when he felt a sense of "drawing" around the thorax, with dyspnoea.

The rubbing sound again occurred the next day, when the whole aspect of improvement was still more marked than immediately after the operation.

I ordered a blister 4×4 , which he complained of most bitterly, and said it was worse than twenty operations.

On the 14th, he left the city for his home.

This case becomes interesting, *first*, from the case with which the patient underwent the operation, and the great relief he experienced, temporarily at least. At the second operation, I was obliged to make two punctures; for, after having made one, the trocar being very thin, broke. At first sight this might seem a very serious matter. It is not so, however; the parts adjacent compress so firmly the instrument, that it cannot move; and it can be taken hold of very readily by the operator. The difficulty is wholly avoided, however, by having a firmer trocar. But the accident compels a second puncture, and it was made in the present case.

Second. The result suggests that we may use the operation in organic disease, for the purpose of lengthening life. I have little doubt that the patient would have soon died, had no operation been performed when he first came under notice.

Third. The results of the physical examination were sufficiently curious; and consisted, as I have noticed in other cases, in the return of the respiratory murmur in some degree; the rubbing sound, and improved sound on percussion; and the gradual disappearance of these favourable signs, and a return of egophony, as the effusion returned.

I cite the case, not because I ever supposed that a permanent cure could be

obtained, but simply, as already seen, to prove the great ease with which the operation is performed, the great relief obtained therefrom, and to suggest that it may be used to lengthen life in an otherwise incurable case. We shall have this point of view brought into still bolder relief in Case VII. of this paper.

After his return home, the patient fell under the care of an "Indian Doctor," under whose directions he grew rapidly worse, with great dyspnoea and delirium, which two symptoms continued until within a few hours of death. He then became rational, and shortly afterwards was found dead in his chair, about four weeks after leaving Boston. A pint and a half of clear, serous fluid was found in the left, and a half pint in the right pleura. The pericardium likewise contained some, and the aortic valves were simply a bony ring. No great hypertrophy of the heart.

CASE III.—J. D., æt. 28, machinist nine years, and obliged during that period frequently to lift a very heavy lever, by pressing the end of it upon his left breast, and, by a sudden jerk, raising it as required. Two years since he had rheumatic fever, and was ill about three months, and had been liable to some rheumatic pains ever since; but, with this exception, had been always well, till his present difficulties commenced. These difficulties were as follows, as I learned them from himself, while a patient at the hospital, under the charge of Dr. Storer. Three months previously, he began to feel some soreness about the left breast, at its upper part, and just beneath the spot on which the end of the lever usually rested. A little dyspnoea was noticed at the same time; and, upon looking at the part, the patient perceived that it was swollen. The dyspnoea gradually augmented, so that, in ten days from the time at which he first felt the soreness, he was obliged to give up work, which he had never resumed. He had some cough at first, for four or five days, but less before his entrance to the hospital. Until a few days previous he could lie most readily on the left side, as he had dyspnoea when on the right.

When I saw him he was pale, lying on the bed dressed, and evidently troubled by dyspnoea, especially during conversation. Respiration 48 per minute; scarcely any motion of the left side of the thorax; movements of the right side, very much exaggerated. Heart beating perceptibly to the finger, four inches to the right of the median line. Left breast very prominent, rounded, and tender on percussion, especially at its lowest part. Left side of thorax, front and back, flat, except at the very apex; but, even there, there was less resonance than in the corresponding part of the right. Change of position produced only slight change of sound. Ægophony under the axilla and around towards the angle of the scapula and vertebrae. Respiratory murmur almost null through the whole of the left breast, around the side, and to within two and a half inches of the vertebrae. Here it was heard slightly. Puerile throughout the right lung. The pulse after examination was 92, equal in both wrists. Patient said he had no cough or expectation. His tongue was clean; his appetite was poor; he was costive.

The diagnosis in this case seemed evident enough, although the fact that the patient referred his complaint to a local oft-repeated strain, seemed peculiar. It, however, had some analogy with the evident cause of pleurisy in our first case. Accordingly, it was decided to puncture the chest.

During his residence in the hospital, he was tapped five times. The first three operations were performed during the first week that I saw him, and with the following results: On the first occasion, the trocar, introduced just under the angle of the scapula, brought nothing but a small quantity of bloody fluid. I presumed (erroneously, as I afterwards believed) that the lung had been punctured. I desisted. No pain of any severity occurred during, or consequent upon, the operation. Two days afterwards I introduced the instrument under the axilla, between the sixth and seventh ribs, and was surprised to find a similar bloody fluid. After removing about $\frac{5}{8}$ i, I again desisted, and, on examining it with the microscope and by chemical reagents, it was decided that the fluid consisted of blood and pus. The non-coagulation of fluid, after standing, likewise convinced us that it was not pure blood. On the 14th of July, I operated again under the axilla, and removed $\frac{3}{4}$ xvi of the same bloody fluid. As usual, little or no pain was felt, until the last moment, when, upon drawing hard with the suction-pump, the patient was somewhat distressed. He, however, arose and walked with more ease. The pulse, which was small before the puncture, was fuller afterwards, and not accelerated. The heart was felt two inches nearer the middle of the sternum, and the patient, besides experiencing entire relief to the sense of distension and soreness of the left side, had lost the feeling as of a hard pulsation about the right mamma.

From this time, the accesses of severe dyspnoea to which he had been subject disappeared, and in three or four days he was able to lie on the right side, which had been impossible before. The dyspnoea on talking still remained. The respiratory movements on the 19th were 36. The pulse, however, was accelerated 108, and the heart was again thrust beyond the right nipple. Digestive organs well. Strength very much as before. Lay dressed upon the bed most of the time, though occasionally he sat up.

On 19th, I punctured the fourth time, and drew with considerable pain a small quantity of fluid that seemed more bloody than previously, and, by the microscope, much fewer pus-corpuscles were found. I was surprised at this result, unless on the supposition of some organic malignant disease; and, as there was no very great distress in breathing, we decided to wait and watch the course of events. The patient continued rather improving in his general feelings till about Aug. 4th, when the dyspnoea became more severe, with greater tumefaction of the lower part of the left chest. The intercostal spaces were on a level with the ribs, but the distance between them was less than at the right. Great tenderness on touching the side. Pulse small, feeble, rapid. Countenance worse; more haggard; emaciation, and great debility.

Under these circumstances, feeling that there was probably organic disease, and certainly very little hope of giving more than a chance of relief and of life, we left the question to be decided by the patient, under a full knowledge of our opinions as to the critical nature of his complaint.

August 11th, he desired the operation; and, accordingly, the fifth puncture was made above the ninth rib, just under and outside of the scapula. One pint of bloody, but more purulent, fluid was discharged, with very marked relief to the dyspnoea and soreness of the chest, and with diminution of the prominence of the side of the thorax. Pulse 108 after the puncture. Previously to this puncture, a soreness had been observed in the sacral region, which, on the 12th, was so large and evidently fluctuating that it was opened with a lancet, with a discharge of pure pus. Aug. 13th, a similar tumour appeared higher up, in the region of the puncture. This likewise augmented, and, on 17th, it was opened with the lancet. One or two ounces of pus were dis-

charged, but, the aperture remaining open, the fluid gradually became more bloody and similar to that drawn through the trocar. This daily discharge gave relief to the dyspnoea, but the strength of the patient failed notwithstanding the use of tonics, and finally he left the hospital. A few days afterwards he died. No autopsy could be obtained.

Remarks.—The length of time the disease had lasted (more than three months) before the first puncture was made, and the peculiar nature of the fluid drawn off, led us to have less hope of doing good than we should have had in a more recent or more common case. Nevertheless, this case, more completely than those previously given, showed to me the innocuousness of the operation, and the slightness of the pain caused by it.

Second. Very great relief followed the two operations.

Third. The peculiar character of the effused fluid was very unusual. At first, it had so much the aspect of blood that, by the microscope alone, I was able to decide as to its nature.

CASE IV.—I saw Mr. P——, æt. 48, June 4, 1850; he was then under the care of Dr. York, of South Boston. By trade a carpenter; he had never been very healthy. He had been sick ten or twelve times in his life, and had raised blood, about 5ii, on one of these occasions. Always liable to attacks of "pleurisy." Ten weeks before I saw him, he had been taken ill, after a severe exposure during a wintry day to a violent and very cold wind, while he was shingling the top of a house. He, however, kept at work for a week, until after another exposure, when he was seized with a severe cough and pain in both sides, more in the right than the left. Some expectoration, five or six ounces, not bloody. His digestion was disturbed; his appetite lessened; at times, some distress after food; bowels regular. He had had, at times, dizziness. Had lost flesh and strength. At my first visit, he looked pale and thin. He could scarcely walk with ease, and talking produced dyspnoea. He was, however, able to sit up, and to move about with some difficulty. The physical signs were as follows: Percussion flat below the fourth rib of the right side, and extending round to the spine by a regular horizontal line. Change of posture produced a slight change of sound in front. Respiratory murmur almost null, from a line an inch above the lower angle of the scapula. In the upper parts of the lung it was much diminished. No ægophony, but the voice was less resonant at the right back than the left.

No r le anywhere in either lung. Right side, by measurement, a quarter of an inch larger than the left, and presenting a much more rounded appearance, especially in front; but the intercostal spaces were not more prominent on one side than the other.

My diagnosis was certainly an effusion into the right pleura. Probably a tubercular diathesis; but no positive evidence of the existence of tubercles in the lungs. I advised the puncture of the chest.

On June 9th, Dr. York introduced an exploring trocar between the sixth and seventh ribs, under the axilla. No fluid followed; but on drawing with the mouth, a small quantity of pus exuded. An attempt was then made to introduce a large flattened trocar and canula; with some difficulty this was done, but no fluid could be procured. The introduction caused much more pain than the exploring instrument. After having, however, introduced it as far as was thought prudent, the operation was abandoned.

11th. Another operation was made. The explorer was thrust in at least two inches; but, in whatever position it was put, nothing but a few drops of blood could be obtained. Thinking it possible that it had perchance passed through the pus into the lungs, I advised introducing it in another place a little forward, and that it should not be plunged so far. Immediately pus flowed slowly, and by the suction-pump we removed nine ounces. The patient felt much relieved, and arose and put on his coat with renewed strength. He had suffered scarcely any from the two punctures. It should be stated that those of the previous operation were hardly perceptible.

As the patient had night-sweats, he was ordered to take acid. sulph. dilut., and a nutritious but simple diet.

Five days after this (June 16th), my notes state that he felt no stronger; but that his cough and expectoration were much less, and that the sweats had diminished two-thirds. Pulse 116; appetite tolerable; slight diarrhoea for two days. Breathing nearly as difficult, but his countenance was better.

July 1 (20 days from the operation). Looks and feels much better; can walk a mile; has gained four pounds in weight; looks more *plump* about the face. On inspection, right side less than the other. Respiratory murmur better than before the operation; but still it is less than in the other lung. Pulse averaged from 100 to 110. In a few days he left the city.

I saw nothing more of him until Nov. 4, 1850, when he entered the hospital under my care; and I learned as follows: After going into the country, he grew weaker; the cough increased, and he expectorated half a pint daily. His appetite had been poor, and he had lost flesh. He looked feebler. He had had no hectic. He had pain in the *left* side of the chest. His pulse at the first examination was 120. Inspection showed no marked difference in size between the two sides. The left scapula was quite movable; the right was nearly motionless. On percussion, less clear at top of the right, increasing to perfect flatness in lower half. No difference on change of posture. Respiratory murmur less throughout the right, and scarcely perceptible below the spine of scapula. Puerile in the left. No râles anywhere, even on coughing.

Diagnosis.—Still no *proof* of phthisis. Undoubtedly, large effusion of fluid. He remained in the hospital until May 6, 1851, when he was discharged, "not relieved." This, however, does not give an exact idea of the changes his local disease and his general symptoms underwent while under treatment. Until March 1, he was under my care, and subsequently under Dr. Shattuck's. I propose to name very briefly the symptoms as they occurred:—

His cough and expectoration, with a general debility, continued until the last. He was always more or less liable to pain in the affected side.

19th. I punctured on a line with the axilla, between seventh and eighth ribs, and could not obtain any fluid.

21st. I punctured four inches further back, and two inches higher; 5 viii of pure pus were extracted. At the latter part of the operation some blood came. A blister was ordered, and also some ale; and iodide potassium 3 grs. three times a day.

24th. Reported better than since entrance; the sputa were a little bloody. Sleep easier than for three months. Gained four pounds in two weeks. The physical signs improved slowly.

Dec. 1 (*i. e.* on 7th day after operation). There was resonance on percussion to the point of puncture. A rubbing sound was heard below the spine of the scapula, and indistinctly below the point of puncture. No râle anywhere.

The constant repetition of blisters, and the use of the iodide of potassium were advised.

7th. The report was that he slept better, &c.; less cough than for 8 months.

9th. A rubbing sound was heard to the base of the lung. Ordered to go out every fair day.

Soon afterwards, the cough increased, and "faintness and sickness" at the epigastrium; the expectoration was greater and bloody. He vomited bitter matter, and nausea remained.

10th. Reported better than since entrance; still gaining flesh; less nausea and expectoration. Right chest flattened, and shoulder lower than the left. Percussion still quite dull over whole right chest, especially at the lower one-third; and the rubbing sound was gone.

Jan. 2, 1851. Symptoms again worse. Heat, chills, &c. and appetite less. Some ægophony.

Between this date and Jan. 20, he had six blisters, four inches square, applied to the side, with decided benefit, and took internally syrup of iodide of iron.

20th. Rubbing sound had returned, and murmur was heard more distinctly. Till Feb. 17, the same treatment; blisters constantly kept sore. At this date the cough was more severe, with 3ii of sputa, of a ragged character. Opiate for cough ordered, and all other medicine omitted.

24th. He reported that he had gained 21 pounds since entrance.

26th. The expectoration and cough were less than at any previous time.

March 4th. Dr. Shattuck found a return of the fluid, as evinced by a change of posture. The cough also increased, and nausea and vomiting. Pulse 116. It had been always quicker than normal.

6th. Some indigestion. Juniper berry tea, nitrate of potass., &c. were ordered.

10th. Iodide of potassium was re-ordered, in doses of 5 grs., to be gradually increased, with blisters.

25th. The right side was found somewhat enlarged, and ægophony again returned with change of sound on change of posture. Pulse 92; skin rather warm; more frequent cough. Ice water compresses to the chest. These were continued for two days, with relief to pain; then omitted, and iodine was ordered to the side, and iodide potass omitted, and $\frac{1}{2}$ gr. oxy-muriate hyd. ordered in syrup sarsaparilla.

During the early part of April, he complained of pain under right clavicle; otherwise remained much as before, save that on the 14th no change of sound on change of posture. Patient continued much in the same condition until May 3d, when he was discharged.

The different phases of this case are as follows:—

Dr. York operated with great relief, and the patient rapidly gained strength and flesh; the pulse fell; and the patient, on the 19th day, walked a mile. He then went to reside in the country, and was not seen again by me until four months after, during which he had fallen back, and the effusion was quite manifest on his entrance to my ward at the Massachusetts General Hospital. Two weeks afterwards I punctured his chest. This first puncture was fruitless. Two days after, another was made, and eight ounces of pus were drawn off; and on the eighteenth day from that time, a rubbing sound was heard all over the lungs, indicating an entire absence of fluid. On the twenty-eighth day the chest was somewhat contracted, and the shoulder was lowered. Meanwhile, all the rational signs were improving. Fourteen days afterwards,

on Jan. 2, another effusion was found to have taken place, marked by distinct physical signs, which, under repeated blisters of large size and iodide of potassium internally, was reduced by Feb. 24th, and the patient felt better than at any previous time. He then passed under my colleague's care; again effusion took place; and, after remaining two months more, the patient was discharged unrelieved from the hospital.

The points most interesting are:—

1st. The failures to obtain any fluid on two occasions of puncture. Of this I shall speak hereafter.

2d. The relief obtained from two operations.

3d. The return of the fluid and subsequent absorption of it under the influence of repeated and large blisters applied to the chest.

4th. The constant recurrence of effusion after repeated relief indicates the extreme difficulty of overcoming the *habit*, if I may so express it, of effusion gained by the pleura; possibly consequent, in part at least, on the long continuance of the fluid in the chest before the operation was resorted to.

5th. May not this last remark suggest to us the importance of operating earlier in cases that fall under our notice in the early weeks of the disease, and oftener in a chronic case? We ought not to allow any fluid to remain accumulated, and in a *quiescent* state, for more than the acute stage; and, in a chronic case, we must watch the earliest return of fluid, and draw it off before it can again distend the pleural sac, as it has done previously.

I am well aware that these are mere suggestions, and that I have no *proof* of their correctness. I think I shall, however, act on these suggestions, unless they should be strongly contraindicated in any particular case. Dr. Wyman assures me that he operated in one case of chronic pleurisy eight or ten times, and there was no permanent relief until the last puncture, at which less fluid was drawn off than at any previous one, and yet the patient apparently obtained greater relief from it than from all the others.

The following case I shall bring forward, in order to show the difficulties which are sometimes met with, which seem for a time insuperable.

CASE V.—*July 14, 1851.*—I was requested, by Dr. Buckingham, to see a little girl, about six years old, who had all the signs of an enormous effusion into the left pleura. No exact history of the case could be obtained; the patient was brought into the wards in the very precarious condition she was in when I first saw her. The left chest was flat throughout. The heart was pushed to the right side; the respiratory murmur was very much lessened. She was evidently in a very hazardous condition; and as the only chance of saving life seemed to be the puncture, I punctured at three different places with two trocars; and although in each opening a little serous fluid exuded, I could not, with the greatest efforts, draw out more than an ounce and a half or two ounces of a thin fluid streaked with blood. If I had had a larger trocar at hand, and fitted to the pump, I should have used it. Not having such an instrument, we desisted. The little patient died in twelve hours, not having suffered, save in the most trifling manner, from the operation. No autopsy allowed.

Many questions arise when reflecting on this case, among which is the fol-

lowing: If we were certain that the patient was rapidly approaching death in consequence of the great effusion, why was not the pleura punctured in the common method, after the method followed by us was inefficient? In reply, I would simply state that it is always very easy to ask and to answer many questions after death, which are not so easy of solution before the fatal moment. Suffice it to say that the question of a more thorough operation upon the chest was mooted and decided in the negative, as I now think, wrongly. In another similar case I should advise the use of the common large trocar, and if that be insufficient, I should recommend a larger opening by incision.

But, regarding this case in connection with the use of the exploring trocar, I think it proves that the puncture can be made several times at once, without causing any very great uneasiness. In fact, the patient did not seem particularly affected by the operation. No increase of any symptom was manifest either during or immediately subsequent to it. The attendants thought her easier after than before the puncture.

CASE VI.—In another case, of a young man who had been long ill, and whose whole form had been distorted by the effusion, I made two punctures under the angle of the scapula without effect, save to draw a little blood. No unpleasant results followed.

CASE VII.—The following case is that of Miss —, whom I saw in consultation with Dr. McGowan, of South Boston, Aug. 21, 1851. She was a spinster, æt. 29. She was never very strong. Many years ago had hip-disease, from the effects of which she is now lame. During every summer she had always been "ailing," and had had some tendency to diarrhœa. During the past winter had some cough after taking cold, and some during this summer. Catamenia generally regular and healthy. Had never had hæmoptysis. Two weeks before I saw her she had had "cholera morbus," and also severe pain in the left side of the thorax. Had not left her bed since this last attack. She had been unable to lie on the right side, and she had felt distended at the left. Cough wholly absent the previous week; some coldness of the feet, followed by fever and night-sweats. When I saw her she was in bed, pale and thin, but with no very great and apparent dyspnœa.

The pulse was 104; the skin cool. The tongue had a thin coat, and patient had anorexia. The diarrhœa had ceased, under pills of opium and acetate of lead. With some difficulty she was raised in bed, and a comparatively cursory examination showed as follows:—

A coarse crackling at the top of the right lung; bronchial respiration, with crackling, at the top of the left, front and back; diminished respiration at the lower parts; puerile in the corresponding parts of the right; percussion, flat over the whole of the left portion of the thorax. The heart was pushed to the right of the sternum.

Diagnosis.—Probably phthisis, with tubercles in both lungs; a few only at the right apex; numerous at the left, with condensation; and, in addition to these, a great pleuritic effusion.

The patient was informed that she had decided lesion of the lung; but that there was a chance of having the evil day put off, if she would consent to a puncture of the chest. At the same time, I promised only temporary relief. She consented; Aug. 23, I introduced the trocar between the eighth and

ninth ribs, below the angle of the scapula. A thin fluid immediately flowed out, and, by means of the pump, forty-one ounces of a thin, yellow, serous-like fluid were drawn out with very trivial pain, excepting during the first puncturing of the skin. Towards the end of the operation, the patient complained of an unpleasant and indescribable feeling about the chest. I accordingly desisted, although more fluid might have been extracted. The wound, as usual, closed immediately, and the patient expressed great relief to the distension of the thorax. No change of the pulse in consequence. It was quiet; at 100, before and after the operation. Her left breast became more resonant, and the heart fell back towards its true position at least one inch and a half. A cough came on during the operation, and was rather irritating from its constancy.

Dover's powder, five grs. ordered. Keep quiet; mild diet. If pain in the side, use bath of hop-tea.

Aug. 24th. She had passed a "delicious night," wholly free from pain and sense of feebleness. The cough had been considerable, and about a gill of yellowish expectoration. Her aspect was much better; less distressed. Pulse quiet, 80. Appetite improved. The fluid drawn was one solid mass, like calf's-foot jelly.

Respiratory murmur heard everywhere, even at the lowest part of the left chest. In front, there was a minute crepitous râle combined with a rubbing sound on taking a full breath. Behind, there were bronchial respiration at the top and indistinct râles below. Percussion showed that the lower third of the left back had become *more resonant* than the upper parts.

27th (4th day). Still improving; night excellent; able to lie on either side. Digestive functions, appetite, &c., better than for some time past. Pulse 80.

On percussion, breasts nearly equal. Behind, much as at former examination. Respiratory murmur as at last visit, except no crepitous râle, *and the râle was evidently less at the top of the right lung.* May chew steak, and have a little port wine.

30th (7th day). Little or no cough, but some pain in the left shoulder and side. More strength; patient sat up ten minutes. Pulse 86 to 90, after examination. In all respects the rational signs were improved. The heart was nearly natural in position. *No râles perceived at the right top.* Respiratory murmur more natural in left breast, but tubular sound very extensive and marked at top of left back. Hop fomentations to the side; cotton wadding over shoulder.

Sept. 3d (11th day). Percussion less dull, and bronchial respiration less at the left top. Slight sonorous râle heard on full breath, everywhere in both lungs. Lower parts of left lung much more free, and murmur heard distinctly to base, though much less clear than at the right. Heart, to the left of the median line, nearly in its natural position.

Up three hours on 1st inst. Pain in shoulder gone. Urine copious and clearer last few days. Some sweating last night. Continue iodide, &c. Apply new blisters. Take acid drops at bedtime.

Sept. 17th (25th day). Patient had continued steadily to improve in certain respects. The strength was much better. Was up all day. No night-sweats. Occasionally, slight febrile exacerbations. Appetite excellent; but, for a few days past, some diarrhoea. Emaciation rather greater. Respiration obscure throughout the whole of the left lung. Bronchial respiration less at the top. Râle only on coughing at top of the right back. No ægophony, or evidence of return of fluid.

Oct. 3d (41st day). Rode over to my office, distance of three miles. Had ridden daily, and was improving; but the tubercular physical signs still remained unequivocal at the top of both lungs, though less manifest than when I first saw her.

Nov. 12th (81st day). To-day I examined her, and found that all the physical signs had decidedly improved. Scarcely any bronchial respiration remained at the left top, and the percussion was less dull there. The respiratory murmur was more distinct throughout the lung. I considered her, nevertheless, a tuberculous patient. She died of phthisis late in December.

Observe some of the interesting points in the case. 1st. The perfect ease with which so large a quantity of fluid was drawn out, and the relief experienced.

2d. The rapid general improvement, although there was tubercular disease.

3d. The fine crepitous r le heard in the expanding lung.

4th. The rapid absorption of what fluid remained, and the falling back of the heart to its natural position.

5th. The lessening and almost entire disappearance of the distinct crackling at the top of the right lung; and the diminution of the signs of condensation at the top of the left.

6th. Is there any one who believes that the forty-one ounces would have been absorbed in ten days?

7th. Was not life prolonged by the operation?

CASE VIII.—The following case I saw with Dr. H. W. Williams, who was kind enough to show it to me.

Mrs. H., Sept. 3, 1851, Irish,  t. 31, married at 18. Had had five children and three miscarriages. Was six months advanced in pregnancy. Had been intemperate, and had had delirium tremens formerly; but said she had drunk no ardent spirits for six or seven months, and this statement was believed to be true. Parents dead. Brothers and sisters alive and well. She had "a pleurisy pain" in the side several years ago, but of late had been well until ten days before Dr. W. saw her, when she had been exposed to fatigue by washing, and thought she had taken cold. After the third day she called at Dr. W.'s office, complaining of some dyspnoea and cough, with pain in the right side of the thorax, and diminished appetite. The tongue was nearly clean, and the pulse not accelerated—nor was the dyspnoea very manifest. Rest and demulcents and a sinapism to the side were ordered.

A week afterwards Dr. Williams was called to her, and found her in bed, with a troublesome cough; pulse 108; considerable dyspnoea; inability to lie horizontally on the left side; great pain on full inspiration; unable to sleep.

Puerile respiration throughout the left chest; absence of respiratory murmur and aegophony at the right, with dulness on percussion below a line one inch above nipple. Dulness varied its place on change of posture.

Trocar introduced about an inch below the lower angle of the scapula, and  xiii of a transparent, serous fluid were drawn out, with an improvement of the pulse and great relief to the dyspnoea.

Three leeches ordered if pain continued; to be followed by a blister.

4th. Night comfortable; slept several hours on the side; dyspnoea greatly relieved; pain much less; pulse 112; tongue nearly natural; chest more reso-

nant at the right; and the respiration could be heard feebly where not heard on third. Fluid taken previous day had a coagulum in its centre.

Blister ordered with iodide of potassium, gr. ii, in syrup sarsaparilla, three times daily.

5th. Better; no pain; pulse 96; very little dyspnoea, but cough very troublesome; auscultatory phenomena better.

Syrup. scill. and tinct. camp. op. for cough.

8th (5th day after operation, 12th of disease). I saw her again. She was sitting in a chair; pulse much as before; pain in the chest and dyspnoea gone, though she panted while speaking; slept better; cough still troublesome, causing a sore feeling in the chest.

The signs of effusion were fully as great as at first. Egophony and dulness of percussion to the middle of infra-spinal fossa. Respiratory murmur heard to that point, though less than at the left side of the vertebra. Below, it could scarcely be heard. In other words, the effusion had returned, but without the previous severe symptoms. Blister reapplied.

During 9th and 10th the physical signs remained nearly stationary, but she felt stronger; the pulse was 104 to 120; she had no pain, and was able to lie partially on the left side. The tongue was a little coated, the appetite poor, with costiveness. Until 16th (13th day from operation, 20th of the disease), she continued improving. On that day, I found her up and preparing her dinner over a stove. She looked nearly well; egophony much less distinct and lower down; some râle about the angle of the scapula on full breath, apparently from the expansion of the compressed lung. Less dulness on percussion.

Feb. 5th (32d day from operation, 39th of disease). Casually, I called on her; she was at the head of her table eating a substantial meat dinner. All the symptoms were gone, save an occasional pain in the side and some dyspnoea (accounted for by her pregnancy, perhaps). Respiratory murmur less expansive in lower part of the right back than before. No râle; no egophony; no difference on percussion of the two lobes.

This case is one of our most interesting: 1st. From the acute character of it—only ten days having elapsed from the first signs of disease. 2d. From the marked relief to the dyspnoea on the removal of the fluid. 3d. From the continued progress of the effusion, notwithstanding the other symptoms, save the cough, were less. 4th. The rapid convalescence from so large an accumulation: viz., on the 20th day the patient was at work, and although the fluid was not wholly removed, it was in the process of rapid absorption. 5th. The complication of pregnancy is important, as indicating that its existence does not prevent us from the use of the trocar.

In reviewing these cases, which I have given chronologically, we may say, 1st, that three out of the eight patients were cured of the pleuritic effusion, and that the operation had an important influence towards that end.

2d. Three of them were materially relieved in their rational and physical signs.

3d. Two of them were not relieved, for no fluid could be obtained.

4th. No one suffered more than slight inconvenience from the puncture.

5th. There were twenty-seven punctures, the largest number in any one case having been five. In two, there was only one puncture.

In one case, three punctures were made in as many minutes.

Symptoms subsequent on the puncture.—After no one of the twenty-seven operations did any serious or unpleasant symptom occur. Some complained more than others of the pain of the puncture. But usually this subsided entirely, as soon as the instrument was fairly introduced, and firmly held by an assistant. Towards the end of the operation, a severe pain was at times felt, or a sense of distension, of stricture, or of dragging; or, what was still more common, a peculiar, indescribable feeling of distress in the affected side. One patient compared it to faintness, and yet said she did not feel faint. *I always desisted when any severe symptom appeared.* There was sometimes a slight soreness about the part for a day or two, but never was there any suppuration or ulceration, and the wound closed instantly on the withdrawal of the canula. The results immediately following any successful puncture were very gratifying. In all, there was a *relief to the sense of oppression*, to the dyspnoea, and to the pain, when it existed. An ability to lie on both sides was gained by some often immediately, in others after 24 or 48 hours. A perceptible increase of physical power was manifested by all. They were able to move about with much more freedom. The men usually were able to put on their coats with less labour, and some seemed to do so even with alacrity, so much comfort in breathing did they experience in comparison with the dyspnoea felt a few minutes previously. In addition to these evident signs, there was an exhilarated mental condition. The mind, as well as the lung, seemed relieved of an intense weight, and displayed itself, among the more mirthful of our patients, in somewhat wild facetiousness and joke—while those of a more quiet temperament showed their delight of mind in a more sober style.

The *pulse* usually remained after the operation much as before. In one, who recovered, it was accelerated for some time after the other symptoms had improved. It was noticed as fuller in one, immediately after the operation, it having been feeble previously. Generally, however, it lessened in frequency after a few days, even if it was destined to rise subsequently on a recurrence of the effusion.

The *cough* was augmented, in most cases, for a few days after the operation. A patient who experienced the greatest relief, and who for a week had had no cough, was seized with one immediately after the fluid commenced flowing; and it was quite severe for about a week, with expectoration of nearly a gill the first day. Both symptoms ceased almost entirely after the lapse of time above named.

The *digestive functions* were usually improved. The appetite became better, or it commenced after there had been complete anorexia. In one patient, there was pain in the abdomen for two days subsequent, and, as it was con-

bined with tenderness and tympanitis, I feared peritonitis. These symptoms disappeared soon after the administration of a cathartic.

The physical signs changed more slowly. In two cases, there was an evident improvement in the results of percussion immediately after the operation; in four, I noted a diminution of dulness towards the upper parts of the chest, on the next day. In two, there was a decided improvement throughout the lung in twenty-four hours. Usually, however, the lower parts were a long time in recovering their healthy tone. This I attributed first, to the fact that the lung, when much compressed, requires considerable time before it can be distended; and second, that commonly there is some thick false membrane covering the layers of the pleura, which must become attenuated before a healthy sound can be produced.

Inspection showed a change in the form of the thorax immediately after the operation in two cases. Commonly, this change took place in a much more gradual manner. There was a perfect restoration of the shape in one case.

A *rubbing sound*, observed in four cases, was noticed in the first twenty-four hours in two, and on the 3d day in the two others. It commenced usually over the breast, and thence gradually extended. I have heard it all over the lung, and, in the majority of the cases, it was quite distinct.

Ægophony.—The time of disappearance of this sign was noticed in only one case. In that, it had gone before the third day.

Once I found a fine crepitous r le existing in a lung, which had been relieved of compression forty-eight hours before. I presume it was owing to the gradual expansion of the compressed lung, because I could not hear it, save after a long breath, and there were no symptoms of pneumonia. *In this same individual, the r le that had existed at the apex of the other lung, and which I had regarded as probably indicating the existence of tubercles, disappeared within a week after the removal of the fluid, leaving only an indistinct crackling or coughing, and forced inspiration.*

One very important sign was quite manifest in two of our cases, viz., *the falling back of the heart*, when it had been dislocated by a large effusion into the left chest. This I observed twice, immediately after the operation, and possibly the same result would have been noticed in others, had I made a sufficiently accurate examination. In one of these cases, the patient perceived it, and said that he felt relieved of the soreness and thumping that had been about the right nipple, previously to the operation. But in all the cases, where there was such dislocation, the operation sooner or later removed it; the organ being longer out of place where pus was effused, than when simple serous fluid was formed.

The *respiratory murmur* was in all the cases a long time before its entire restoration, although a very decided change was produced in a few days. In one case only has this been perfect, after many months of illness. Two others may be in the category, but they are still under treatment. The character of the fluid in the chest has apparently some influence upon the result, as the

following table will indicate. In four cases, two purulent, two not so, we have

	Respiration tolerably clear in	Respiration quite clear in
Purulent cases Non-purulent cases	24 hours and 3 days.	8 months or never.

The reason for this difference is probably the existence of the thick membrane before alluded to.

Quantity and quality of the fluid removed, and their influence on the result. The quantity varied from $\bar{\text{v}}$ iv to $\bar{\text{x}}$ li. The medium of six operations was $\bar{\text{x}}$ xiv. Although the removal of a large quantity (30 or 40 oz.) gave very decided and prompt relief, as much apparent comfort was at times experienced when a smaller quantity (9 oz.) was removed.

The quality of the fluid was pure pus in two patients. Of these, one is now wholly well. The other is tuberculous. In four it was a thin, yellow fluid, which coagulated on standing. Of these one recovered; one has lost all traces of effusion, but she has tuberculous lungs. A third, having cardiac disease, died, but the effusion never returned to so great amount after the operation, and life was prolonged by the operation. In the fourth, there was probably coagulation of the fluid in the chest, and it could not be drawn off. My inference from these facts is that the quality of the fluid cannot afford us any indication as to the prognosis, save that when a purulent fluid occurs, a longer time is occupied for cure, as we have previously stated.

Finally a bloody fluid was found in one. He did not recover.

Our cases are so few that we can give but little positive information upon the effects, produced by the age of the patient and the duration of the disease, upon the ultimate result of the operation.

In six cases, the average age was thirty-three and one-third years; the oldest, fifty-six; youngest, twenty-eight.

Great age has been generally considered unfavourable for the operation of paracentesis. Of three of my cases, in which one got wholly well, and the others are rapidly improving, though still under treatment, the average age is twenty-nine and one-third, or four years less than the average. Of the three other cases, none of which have been *permanently* improved, the average age is forty-two, or more by nine and a half years than the average.

The length of time the disease has lasted is of as much importance perhaps as the age of the patient. The respective durations of the disease previous to the operation in the three cases above named, in the first category, were six weeks, two weeks, and ten days; average, twenty-two days.

In the last three, one had had dyspnoea seven years, and had grown much worse during the previous seven months. In the next, the patient had been

ill ten weeks of pleurisy, and had had hæmoptysis. Finally, in the third patient, the disease had lasted for three months.

As far as our cases go, therefore, they prove that youthfulness on the part of the patient, and early puncture, give more favourable results than the contrary conditions. The latter part of this opinion coincides with the suggestion made by a late reviewer.* I am satisfied that it is correct.

Under what circumstances should the operation be performed?

1st. There cannot be a doubt that it should be performed in all cases, either acute or chronic, in which there is dyspnœa sufficient to threaten death.

2d. I believe that the case of the little child about whom I was consulted in 1849 (*ante*, p. 323), proves that the operation should be performed where the pleura is *distended* with fluid, even if the dyspnœa is not permanent, but only paroxysmal, the patient being in the interval comparatively easy. Life might have been saved in that case, if the puncture had been made; but the little patient seemed so well, that we decided to defer it till a more serious symptom should occur. It will be remembered that that very night the patient died in a sudden attack of dyspnœa.

3d. I think that we ought to operate in a somewhat chronic case, where these paroxysms occur, even if the chest be only partially filled with fluid. I saw a man this spring who had been ill about three months, and had evidence of fluid filling one-half of one pleural cavity. It was thought best to try remedies before puncturing. In three or four days, he suddenly expired in an access of dyspnœa.

4th. In all *acute* attacks, where the remedies employed do not seem to produce ready absorption, the operation should be performed. Dr. Hamilton Roe says that three weeks is the longest time we should allow the fluid to remain in the chest.†

5th. In all effusions, where one side of the chest is full and distended with fluid, I shall advise it, even if there be no great dyspnœa or other serious symptoms; *a*, because it is rare for one having a pleura *distended* with fluid to get well; *b*, because the operation can do no harm; *c*, it may prevent a tedious illness; *d*, because it may prevent the development of tubercles; *e*, it will probably prevent future contraction of the chest; finally, because in that way an external opening and a harassing fistulous discharge may be avoided.

6th. Case VIII. proves that, although in a very acute case the puncture may not prevent the re-accumulation of the fluid, nevertheless, the operation may be of great service in relieving the prominent symptoms of dyspnœa, and helping on the more rapid cure. It may, therefore, become a question whether even a small quantity of fluid should not be removed within a week after the first attack of acute pleurisy. Time and future cases must

* British and Foreign Med.-Chirurg. Review, Oct. 1851, p. 501.

† London Lancet, vol. ii., 1844, p. 190.

decide this. Upon this part of my subject, I cannot refrain from quoting the remarks of the reviewer above alluded to. "The whole argument turns on the facility and safety with which paracentesis can be performed, and although the cases are not sufficiently numerous to allow us to recommend it as in all cases practicable and useful, yet they warrant us in stating that this operation is one of which practitioners have too much dread; and that, when skilfully performed, it may be practised with very little hazard to the patient, and with a result, in the majority of cases, that is satisfactory to the practitioner."

Objections to the Operation.—There are two classes of objections (*viz.*, theoretical and practical) brought against the operation of paracentesis thoracis. I confess that they are very formidable, nay, insuperable, when applied to it as recommended in most books of surgery. That is, in fact, a barbarous operation, and I believe will be, ere long, regarded as such by every one. It leaves an open, gaping wound, through which rushes the external air with each movement of the thorax. But the modern European method by trocar and canula, as performed by Trousseau and Hughes, &c., and especially as it has been modified and improved by Dr. Wyman, is one of the simplest and safest of all operations. Still there are objections, theoretical and practical, brought against it. Let us consider, then, their value.

1st. It is said that the chest, being a bony cavity, cannot contract; *ergo*, you never can get out the fluid, or you do so at the risk of injuring the lungs; the objector forgets that the diaphragm and intercostal muscles prevent the thorax from being a bony cavity, and do allow of some contraction. Still further, by means of the suction-pipe, we draw out the fluid, and thus form, perhaps, a vacuum in the pleural cavity. The compressed lung dilates; the other lung likewise admits more air and crowds into the empty space.

But, 2d, the objector adds, by forcibly compelling the lung to dilate, you run the risk of seriously injuring it. How do you know this, save by experiment? Now experiment proves that nature always gives us notice, by the suffering of the patient, how far we may go in the operation of suction. I have myself operated twenty-three times, and Dr. Wyman has done so many more times, and in no single instance has any permanent evil resulted from this cause. We have always desisted the moment any complaint was made by the patient.

3d. It is said you cannot draw out all kinds of fluid. Very true, there may be such cases, I have met with them; but, I think, they will be less numerous as we become more accustomed to the operation, and it is done more properly. Besides, we can always, if necessary, have recourse to the old operation, if the trocar fails.

4th. But you will let air into the pleura. This, to some minds, is a serious theoretical bugbear. The admission of a small quantity of air does not necessarily cause trouble, unless it be frequently repeated, as in cases of pneumo-

thorax, and of puncture of the thorax, according to the old operation. I have seen air accidentally *pumped into* the chest, instead of fluid being drawn out! And this caused no injury. The patient never knew of it by his own sensations. I do not believe it excited any inflammation. I am not alone in this opinion. Other operators believe the same; for they have observed the same accident, with similar results attendant thereupon.

5th. You run a great risk of exciting pleuritis by the puncture of the delicate pleural membrane. It is a sufficient answer to this objection that, at the autopsy of cases in which persons have died from other diseases, after a puncture with a fine trocar, no evidence of inflammation from that cause has manifested itself. Case I., given above, also proves it, by showing a similar non-purulent fluid drawn out on two successive operations. Dr. Wyman has noticed this frequently. I have never known pleuritis to ensue.

6th. You may injure the lung, or strike some other important organ.

Very true; but, 1st. I deny that a puncture of the lung is so very dangerous. It has been done. It was done in a case, as Dr. Wyman believes, under Dr. W.'s care. I have done it. I have seen another do it, and, moreover, use the suction-pipe while the trocar was in the lung. In no case has any evil resulted. The sputa were, in one case, slightly tinged with blood soon afterwards, but no unusual pain or distress resulted to the patient. But, 2d, these are exceptional cases. If our diagnosis be conscientiously and thoroughly made, we need very rarely injure the pulmonary structure. If we injure any other organ, it will generally be owing to our own carelessness.

7th. The intercostal vessels or nerves may be injured by the trocar.

This is possible, but not probable. 1st. It would be difficult, in fact, to strike and seriously injure the artery, because the trocar is so small that a small artery would most probably glance aside. 2d. The spot for the operation may be chosen where the vessels are the most minute. 3d. The operator, of course, will thrust the instrument as near to the upper edge of the rib as is possible. 4th. Finally, among all the operations performed within the past eighteen months in Boston and its vicinity, no serious result has happened to the artery, although, in one case, I observed some slight and temporary hemorrhage after the withdrawal of the trocar.

8th. One objection brought against the operation is the following, viz.: That all cases of chronic pleurisy will get well after a time, unless the disease be dependent on more serious lesion of the lungs, or other remote organs. In answer, I would say that, according to my experience, in part already given above, it is not true that a person affected with chronic pleurisy as an idiopathic disease will eventually get well. He may die, as we have seen, in various ways, which result a puncture and extraction of the fluid may prevent. But, still further, is it of no use to shorten the disease by months? Is it of no service to prevent fistulous opening, and those terrible distortions of the chest consequent on the cure of long pleurisy? Moreover, suppose that tubercular or other disease exists, is it of no service to raise, as was done in

Cases II. and VII., our patients from their bed, to give freedom of breath, and to actually lengthen life?

Again; I believe that this operation will be used with advantage in *acute* disease, and may, likewise, shorten *its* course. Case VIII. shows this, where the patient, on the twenty-third day, was up and preparing her dinner, and the effusion subsiding. Case VII. is a still more striking example of this; *i. e.* if we regard the pleurisy as having commenced when the pain in the side began. If this be so, then the cure was complete in a very few days after the operation.

9th. Finally, some object to the operation because of the uncertainty of diagnosis. You may operate in a case of cancer of the lung, or gangrene, or some other disease than pleurisy.

I can conceive of such an error being made in some very rare cases, but I do not believe that such cases will be likely to happen very often; and, moreover, as I have already said, I think that a slight puncture of the lung with a small trocar is of very trivial moment. We may, therefore, very justly put aside this objection as one of little value against the operation.

Diagnosis of pleuritic effusions.—Strictly considered, this question does not belong to this paper; but I feel that its great importance allows me to treat briefly of it. I pass over the rational signs; for, although of the greatest value in the diagnosis, prognosis, and treatment, they have no bearing upon the special object we have now in view. Let us trace rapidly the various physical signs.

Inspection.—This should never be neglected. When the chest is full of fluid, you will find an immobility of the affected side, and a general roundness of the whole of it. At times, however, there may be a local swelling, and especially is the breast liable to be unduly prominent. In one or two instances, this was so great as to suggest the idea of some lobulated organic disease, rather than a simple effusion. Mr. McDonnells (*British and Foreign Med.-Chirurj. Rev.*, July 1845, p. 248) has apparently observed the same facts, and has moreover found some cases in which there was a pulsation, causing the idea of aneurism to be suggested to the mind of the observer. The pulsation was, however, caused by the dislocated heart pressing strongly against the parietes of the pleuritic abscesses. I have never seen anything like this; but I would suggest that, in such a case, the flatness, that would undoubtedly exist at the back of the chest, and the ægophony, would enable us to come to a tolerably certain diagnosis. I have never seen the intercostal spaces *prominent*; they have usually been on a level with the ribs; but sometimes the spaces were even *narrower* than those of the other side. It seemed as if the healthy side expanded itself to the utmost in order to do its double work.

Palpation teaches us many things that inspection likewise displays. In large effusion, there is often exquisite tenderness of the whole breast and side, which usually disappears after the removal of the fluid. The natural vibration

of the voice, felt by the hand placed on the thorax is lost at the side containing the fluid.

Auscultation.—The respiratory murmur may be diminished, or destroyed, or made tubular by an effusion. When there is a large quantity of fluid, and the lung is compressed, the murmur is generally almost, if not wholly absent, especially in the lower or back parts of the chest. At times, however, a tubular sound is heard. This is most distinct about the angle of the scapula. Even in this case the lower two or three inches have scarcely any respiratory murmur. This fact usually distinguishes pleuritic effusion from pneumonia, in which the bronchial respiration is more extensive than in pleurisy. Of course, when there is not a complete compression of the lung, the murmur must be heard somewhere, and most clearly at the apex. Generally, it may be said that the murmur in the lung, even when partially compressed, is less throughout the front and back of the affected side. This fact likewise separates effusion very clearly from pneumonia, or any malignant disease of the lungs. The usual absence of râles helps in the diagnosis of pleurisy. This, however, is not a certain proof, because phthisis may exist, and the râles will in that case be heard at the top of the lungs. This was the case in our 7th observation. Pneumonia, or severe bronchitis may, very rarely, exist with pleuritic effusions, and they will present their characteristic râles lower down in the lung. In such a state of things, we must have recourse to other signs.

The *voice* is always altered. It may be less, or it may be louder, or it may be modified ægophonically. Either of these alterations, combined with other signs, I consider important. True ægophony is rare; and, when it exists, I should consider it an almost certain proof of the existence of a pleuritic effusion; but I have no confidence that it will show the amount of that fluid.

Percussion.—This is the most perfect means we have of detecting the existence of a fluid. We recognize a fluid by its perfectly *flat* sound, and the inelastic sensation given to the finger. Gangrene of the lungs may produce a similar sound, but it is limited in extent, and rarely shows itself (by percussion) at the base of the lungs. I never had but one case of pneumonia at all resembling pleurisy in its peculiar dullness of sound. Cancer of the lung may cause equal flatness, but it is not apt to be uniformly distributed; hence we often obtain a clear sound below the level of a part that is flat.

But the *experimentum crucis* which, when it occurs, absolutely proves the existence of a fluid, is the change of sound according to the change of position of the patient. When the pleural cavity is full of fluid, this trial is of no avail; because, in whatever posture the patient may be placed, all parts must necessarily be flat. A similar result occurs when there are adhesions confining the fluid. Neither of these causes is of common occurrence; the former, however, is much more likely to occur than the latter.

Displacement of the Organs.—Examination should be made upon this point in all cases. When the effusion is in the left side of the chest, this

examination affords us an almost certain sign of it, for we shall find the heart more or less dislocated to the right, even beyond the sternum.

In three of our cases (I., III., and VII.), this state of things was quite manifest. The undue projection of the liver and spleen from under the cartilages of the ribs, whether due to actual dislocation or to enlargement, as suggested by Mr. McDonnell,* is of minor importance as a diagnostic sign.

Is it possible, before operating, to determine the quality of the fluid contained in the chest? I think not; although we may suspect it. In general, it may be said all effusions consequent on organic diseases, not contiguous with the pleura, are of a non-purulent character. In pleurisies proper we cannot decide, *à priori*, whether we shall find pus or other fluid. The more intensely inflammatory the general symptoms are, the more must we anticipate pus. The chronic nature of the complaint affords no criterion by which to judge, inasmuch as sometimes a perfectly clear fluid remains for months. The presence of hectic paroxysms, which I formerly thought nearly pathognomonic of a purulent condition, I have learned to think of little value in the solution of the question. After the operation has been more frequently performed, we may be able to answer it more satisfactorily.

Dr. Hamilton Roe, in the paper already alluded to, believes that a prominence of the intercostal spaces is one proof of the purulent character of the fluid contained in the chest. Others, however, do not agree with him in this particular. Our Case IV. proves Dr. Roe to be wrong, if he lays down this as the undeviating rule.

Mode of operating proposed by Dr. Wyman.

He uses an exploring trocar, and one of the smallest kind will answer. It is well to have the instrument a little firmer than those usually prepared for simple exploration; for twice I have seen those small ones broken off within a very short distance above the surface of the skin. And, although this accident caused, in neither instance, any serious trouble, another puncture was necessary in both cases.

In addition to the trocar, and an important item in the success of the operation, is the suction-pump, applied to the canula on the principle recommended by Guérin and Higginson. Guérin has an apparatus much less convenient than that which I have used, which consists of a pump without valves. (See figure, page 350.) A solid brass cone is ground so as to turn in a perfectly air-tight manner within a brass cap. In this way, by a series of apertures, we can draw up the piston and fill the pump; and then by a simple turn of the cone, about 90 degrees, within its cap, and pressing down the piston, the whole contents of the barrel are discharged from another aperture. The operation of suction may thus be repeated rapidly, and without any removal of the pump or turning of stopcocks, as proposed by Guérin.

* Dublin Journal, March, 1844, and British and Foreign Med. Rev., vol. xx., 248.

Accident, and a desire to accommodate a patient, led me to employ a slight modification of Dr. Wyman's plan. I observed that when the pump was fitted directly to my canula, I could not help frequently jerking the instrument in such a way as to cause suffering to the patient. By using a strong gum-elastic tube which will not collapse, and which by one extremity screws into the pump, while the other is fitted by an air-tight brass cap very closely to the canula, all trouble is avoided. Moreover, by this arrangement, I am enabled to allow the patient to be placed in many positions which would be very inconvenient, if not impossible, if I did not use it.

Where should the puncture be made?

It is evident that it will be wise to introduce the trocar as low down as possible, consistently with the safety of important organs within the chest or abdomen. The spot usually chosen by Dr. Wyman and myself is just under the lower angle of the scapula, between the seventh and eighth, or eighth and ninth ribs. This point is chosen, first, because it is easily reached; second, the muscles covering the thorax at this part are thin; third, the intercostal vessels are as small there as elsewhere—possibly they may be smaller. The intercostal space is sufficiently large to easily admit of the passage of the trocar. At times, I have operated more under the axilla, the patient's arm being raised by an assistant; but some might fear to injure the heart if operating on the left side. Assuredly, we should be careful of puncturing under the left axilla, unless there is a large effusion which has dislocated the heart to the right; and, if such be the fact, there is no danger, unless the trocar be forced into the thorax much farther than is needed. The same objections cannot be made to operations upon the right side. With a reasonable degree of caution in our diagnosis, and if, when puncturing low down, we raise the point of the instrument instead of depressing it, we shall avoid the diaphragm, liver, or spleen.

Position of the Patient during the Operation, Mode of Operating, &c.—If possible, I prefer to have the patient sitting sideways in a chair, or astride, with his face towards the back of it. If he be too feeble to rise, he may be in a semi-recumbent posture reclining on the bed. In either case, it will be well to let an assistant support him. The position first assumed I have generally allowed him to retain; though some of the European operators advise a change, so as to allow the fluid to flow to the point of puncture. This will rarely be necessary.

Some advise that the skin should be slightly incised with a lancet before puncturing. I have never found this to be necessary; but, having carefully examined the best point at which the trocar should be introduced, I press the forefinger of my left hand deep into the intercostal space, and then, using that as a guide, I quickly plunge the trocar through the parts, as near as possible to the upper edge of the lower of the two ribs. The resistance is at

times considerable; but the sensation produced by the passage into the pleural cavity is quite easily recognized. I then withdraw the trocar, and, if no fluid flows, I introduce a probe through the canula, and explore the cause; and, if necessary, I force the tube further in. Sometimes, the false membrane on the pleura costalis is raised on the point of the instrument, and we escape that obstruction, by thrusting the instrument farther in. At times, however, even this is insufficient, owing to the purulent or coagulable nature of the fluid. In this case, suction may be applied, and if blood alone flows, or if any suffering is caused to the patient, another opening must be made, or the operation be given up, or the old method resorted to. If the fluid, as is usually the case, flows freely, the tube and suction-pumps should be fastened to the cap of the canula; and if possible, it should not be removed therefrom, until the operation is over, and the canula drawn from the chest. An assistant should support the canula, and keep it wholly quiet; much suffering to the patient is thereby prevented. If before much fluid has been withdrawn the canula seems to have become clogged, the suction may be removed and the tube may be probed; but this is to be avoided if possible.* At the termination of the operation, *i. e.* when a large quantity has been withdrawn, or the patient complains of severe distress with each attempt at suction, we should carefully withdraw the tube. No dressing, or the slightest compress only, will be needed, and if any pain occur, it may usually be overcome by mild opiate applications.

The following figures will afford an idea of the instruments employed by myself. They are represented two-thirds of their actual dimensions, except that the barrel of the pump is given merely by its two extremities, in figures 1 and 2. The barrel is eight inches long from *a* to *b*.

Fig. 1. *c*, strong handle. *d*, piston-rod, with a small wire soldered to it, so as to prevent the turning of it, without moving the whole barrel. It would be better to have it square.

Fig. 2. *e*, termination of the barrel in a cone, which plays very closely in a cylinder, *f*, which surrounds it, and to which it is fastened by a large nut, *g*. *h* is a screw to which a tube may be fastened, in case the instrument is to be used as a stomach-pump.

Figs. 3 and 4 show in detail the cone and its investing cylinder.

Fig. 3. *i*, a wire which, by striking against the notches near *s* and *o* (Figs. 2 and 4), prevents the contained cone from moving except within certain limits. *k*, aperture in which the elastic tube is screwed previously to fastening it upon the trocar for the operation. It is on a level with *n* (Fig. 4), which communicates with the interior of the barrel. From this we see that, if *i* be brought up to the notch *o* (Figs. 2 and 4), the pump will be prepared for suction through *k*. *l* and *m*, two apertures opening inside of the investing cylinder, and communicating with each other by means of a passage-way in the walls of the cylinder. From their position relatively to *k*, it will be perceived that, if *k* be moved, or what is the same thing, if the cylinder be held

* In one case in which I have operated since this paper was written, I punctured twice the same day. My reasons for doing so were these: I had punctured under the scapula, and drawn off about twelve ounces; when the fluid, of which I was satisfied there was still a quantity, ceased flowing, and no amount of motive power could make it flow. I then introduced the trocar one or two inches higher and in front, when immediately the water escaped, and fifteen ounces more were taken away. I may add that neither puncture caused suffering.

firmly, and the barrel with its terminating cone turned so that *i* shall rest at *s* (Figs. 2 and 4), the two apertures *l* and *m* will correspond to *s* and *p*, while *k* will be closed. By this change, a continuous tube from *a* to *b* is made, and the fluid drawn up into the barrel may be immediately discharged. This operation may be indefinitely repeated.

Fig. 1.

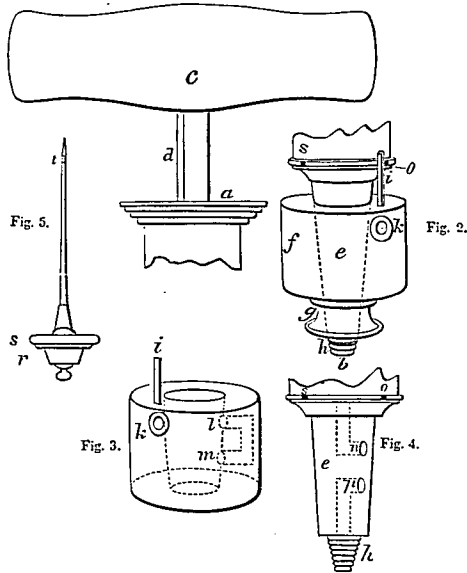


Fig. 5. The exploring trocar and canula (two-thirds of the actual size), *r*, a cap of brass, ground smooth for insertion into the elastic tube, in a perfectly air-tight manner. *s*, solid arms of the same material, for the more easy and firm management of the instrument. *t*, apertures in the side of the instrument, through which a fluid can be drawn in case the end of the canula be obstructed.